



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Takeshi Oohashi et al.
Serial No. : 09/926,033
Filed : November 7, 2001 (PCT filing date: March 2, 2000)
For : PHOTSENSITIVE RESIN COMPOSITION,
PHOTSENSITIVE ELEMENT USING THE SAME, PROCESS
FOR PRODUCING RESIST PATTERN AND PROCESS FOR
PRODUCING PRINTED WIRING BOARD

Art Unit & Examiner : Art Unit 1752
Examiner Thornton, Yvette

DECLARATION UNDER 37 CFR 1.132

Assistant commissioner for Patents
Washington, D.C. 20231

RECEIVED
MAY 26 2004
TC 1700

Sir:

I, Takeshi Oohashi, Japanese citizen, residing at c/o Hitachi Chemical Company, Ltd., Yamazaki Works, 4-13-1, Higashicho, Hitachi-shi, Ibaraki 317-8555 Japan, declare and state that;

1. I have a degree in engineering, which was conferred upon me by Hokkaido University, Graduate school of Engineering in Sapporo-shi, Hokkaido, Japan, in March, 1997.
2. I and have been employed by Hitachi Chemical Co., Ltd. since April, 1997, and I have had a total of seven years of work and research experience in the development of photosensitive film.
3. I am one of the named inventors of the above-identified application and am familiar with the subject matter disclosed in said application.

4. Lipson et al. (U.S. Patent No. 4,539,236) do not disclose the claimed photosensitive resin compositions. The reason is that they do not teach using the specific photopolymerization initiator (B) and the photopolymerizable compound (C), (C') or (C'') that are contained in the claimed photosensitive resin composition. In the components (C), (C') and (C''), m, which is the repeating number of alkylenoxy or ethylenoxy group, is an integer of 6 to 18 or 20. Lipson et al. disclose acrylates wherein the repeating number of alkylenoxy group is 1-12. However, they teach the repeating number is most preferably 2 or 3 (column 4, lines 25-26), and in working examples, they do not use other acrylates than acrylates wherein the repeating number of alkylenoxy group is 3 or 4, and do not present any data showing the effects of acrylates wherein the repeating number of alkylenoxy group is 6 or more. That is, the practical teaching of Lipson et al. is limited to photosensitive resin compositions containing acrylates wherein the repeating number of alkylenoxy group is 4 or less.

Ishikawa (JP 10-020491 A) does not disclose the claimed photosensitive resin compositions. The reason is that Ishikawa does not teach using a binder polymer (A) containing styrene or a styrene derivative as a copolymerized constituent and the photopolymerizable compound (C), (C') or (C'') that are contained in the claimed photosensitive resin composition. Ishikawa teaches using a binder polymer, which however does not contain styrene or a styrene derivative as a copolymerized constituent. Ishikawa discloses acrylates wherein the repeating number of alkylenoxy group is 3-20. However, in working examples, Ishikawa does not use other acrylates than an acrylate wherein the repeating number of alkylenoxy group is 4, and does not present any data showing the effects of acrylates wherein the repeating number of alkylenoxy group is 6 or more. That is, the practical

teaching of Ishikawa is limited to photosensitive resin compositions containing acrylates wherein the repeating number of alkylenoxy group is 4.

5. I conducted experiments (Experiments 4-6) to show the technical effects caused by the difference between the photosensitive resin composition of the claimed invention and those taught by Lipson et al. or Ishikawa (JP 10-020491 A). The following test results show the effect of the claimed invention, which is not expectable from the teachings of the cited references. In the following table, Experiments 1-3 are the same as those presented in the previous declaration filed on September 22, 2003.

Experiment 4

The preparation of a solution of a photosensitive resin composition and a photosensitive element and the evaluation of adhesion and scum were repeated in the same manner as in Example 1 of the applicant's specification except that 10 g of phenoxynonaethylenoxy acrylate was used in place of 10 g of nonylphenoxyoctaethylenoxy acrylate.

Experiment 5

The preparation of a solution of a photosensitive resin composition and a photosensitive element and the evaluation of adhesion and scum were repeated in the same manner as in Example 1 of the applicant's specification except that 10 g of methoxyhexaethylenoxy acrylate was used in place of 10 g of nonylphenoxyoctaethylenoxy acrylate.

Experiment 6

The preparation of a solution of a photosensitive resin composition and a photosensitive element and the evaluation of adhesion and scum were repeated in the same manner as in Example 1 of the applicant's specification

except that 3.0 g of benzophenone was used in place of 3.0 g of 2-(o-chlorophenyl)-4,5-diphenyl-imidazole dimer.

The results of the experiments are given in the following table. The data of Example 1 and Comparative Example 1 are those disclosed in the specification.

The evaluation in the Table is as follows:

Adhesion: the width of the narrowest fine line remained adhering after developing.

Low tendency to scum:

No: Scum did not occur.

Yes: Scum occurred.

As shown in the Table, the photosensitive resin compositions of Example 1 and Experiments 1,2 and 4, wherein phenoxypolyalkylenoxy acrylates having 6-18 alkylenoxy groups were used, had excellent adhesion and did not generate scum, indicating excellent low tendency to scum. On the other hand, in Comparative Example 1 and Experiment 3, wherein phenoxypolyalkylenoxy acrylates having 1 and 4 alkylenoxy groups were used, scum occurred. Experiment 5 shows that alkylenoxy acrylate having no phenoxy group cannot impart good adhesion even though it has 9 alkylenoxy groups. Experiment 6 shows that good adhesion cannot be attained when a photo-polymerization initiator other than a 2,4,5-triaryl-imidazole dimer is used.

	Components	Ex.	Co. Ex.	Experiments					
		1	1	1	2	3	4	5	6
(A)	Binder polymer *1	60g	60g	60g	60g	60g	60g	60g	60g
(B)	2-(o-chlorophenyl)-4,5-diphenyl-imidazole dimer	3.0g	3.0g	3.0g	3.0g	3.0g	3.0g	3.0g	-
	Benzophenone	-	-	-	-	-	-	-	3.0g
	N,N'-tetraethyl-4,4'-diamino-benzophenone	0.2g	0.2g	0.2g	0.2g	0.2g	0.2g	0.2g	0.2g
(C)	nonylphenoxyoctaethylenoxy acrylate	10g	-	-	-	-	-	-	10g
	nonylphenoxyhexaethylenoxy acrylate	-	-	10g	-	-	-	-	-
	nonylphenoxyoctadeca-ethylenoxy acrylate	-	-	-	10g	-	-	-	-
	nonylphenoxytetraethylenoxy acrylate	-	-	-	-	10g	-	-	-
	nonylphenoxyethylenoxy acrylate	-	10g	-	-	-	-	-	-
	Methoxynonaethylenoxy acrylate	-	-	-	-	-	-	10g	-
	Phenoxyhexaethylenoxy acrylate	-	-	-	-	-	10g	-	-
	EO, PO-modified urethane dimethacrylate	10g	10g	10g	10g	10g	10g	10g	10g
	2,2-bis[4-(methacryloxy-pentaethoxy)phenyl]propane	20g	20g	20g	20g	20g	20g	20g	20g
Others	Leuco crystal violet	0.5g	0.5g	0.5g	0.5g	0.5g	0.5g	0.5g	0.5g
	malachite green	0.05g	0.05g	0.05g	0.05g	0.05g	0.05g	0.05g	0.05g
Solvent	acetone	10.0g	10.0g	10.0g	10.0g	10.0g	10.0g	10.0g	10.0g
	toluene	10.0g	10.0g	10.0g	10.0g	10.0g	10.0g	10.0g	10.0g
	methanol	3.0g	3.0g	3.0g	3.0g	3.0g	3.0g	3.0g	3.0g
	N,N-dimethyl formamide	3.0g	3.0g	3.0g	3.0g	3.0g	3.0g	3.0g	3.0g
Adhesion		20	20	20	22	20	20	32	40
Scum		No	Yes	No	No	Yes	No	No	No

*1: a (copolymer of methacrylic acid/styrene/methyl methacrylate = 20 wt%/20 wt%/60 wt%, Mw: 60,000, Acid value: 130 mgKOH/g)

6. The undersigned DECLARANT declares further the all statements made herein of his/her own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that the willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Executed this 11th day of May, 2004.

Takeshi Ohashi

Takeshi Ohashi